EXPERIMENTS

AND

OBSERVATIONS

ON

URINARY AND INTESTINAL

CALCULI.

WITH ENGRAVINGS.

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"Whilst so many sages and philosophers, have consumed a long and laborious life in exploring the recesses of the temple of medical science, new discoveries can scarcely be expected from him, who with trembling and uncertain steps, is yet lingering on the threshold."

I. E. STOCK. *Inaugural Essay.*

PHILADELPHIA:

PRINTED BY CARR & SMITH.

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1801.

AN

INAUGURAL ESSAY,

FOR

THE DEGREE

OF

DOCTOR OF MEDICINE;

SUBMITTED TO THE EXAMINATION

OF THE

REV. JOHN EWING, S.S. T. P. PROVOST;

THE

TRUSTEES AND MEDICAL FACULTY

OF THE

UNIVERSITY OF PENNSYLVANIA,

ON THE

EIGHTH DAY OF JUNE, 1801.

INTRODUCTION.

THE author of the following eſſay can boaſt of but little more, than having repeated with care, a few experiments long ſince made by ſome of the moſt eminent chemiſts. In ſome points of view, his experiments may be ſeen to differ from thoſe of others but, he preſumes that, when taken together they will ſerve as an evidence of the correctneſs of ſome of his experimental predeceſſors; and that abſtractly conſidered, they may throw ſome new rays of light on the nature of urinary and inteſtinal calculi. If the laſt effect be produced, he can only attribute it to the occaſional, yet abſolute difference which exiſts between diſtinct calculi, and not to any uncommon or ſuperior degree of accuracy in his own experiments. In point of deſign, he is fully ſenſible of their inſufficiency; but he can aſſure the reader, that as he had no particular object in view which could bias his

mind, he hopes their reſults have been detailed with candour and integrity.

It may not be deemed altogether unintereſting, to ſay a few words in this place, concerning the formation of calculi in the animal body, and the manner in which they are ſaid to be affected by medicines internally adminiſtered.

The matter of urinary calculus, is properly ſpeaking, a true and natural ſecretion of the kidneys. The purpoſes for which this ſecretion is performed, we are unable even to form a conjecture; of the conſtituent parts of this matter, the lithic acid of Scheele more properly called by Mr. Fourcroy the *urinic acid*,* is the moſt conſpicuous: It is an acid *sui generis*, and found only in the urinary paſſages of animals:† of its nature, and habitudes with other bodies, we are wholly unaquainted. That the ſecretion of this particular acid, as well as of all the other component parts of calculus, is not a diſeaſed one, is ſufficiently proved by the decompoſition of

* Dr. Pearſon has denied the exiſtence of the lithic acid; he ſays, it has none of the properties of acids, although this has been fully eſtabliſhed by the experiments of Mr. Fourcroy. See his anſwer to Dr. Pearſon, in the 2nd volume of the Philoſophical Magazine.

† Dr. Pearſon ſays, he has found it in gouty concretions.

healthy urine,* the products of which, are precisely the same as those of stone. In confirmation of this, we need only recur to a fact familiar to most observers:—I mean the actual formation of calculus upon the walls of privies, and other public places. If the matter of calculus be uniformly and naturally secreted with the urine, how useless and absurd do the voluminous speculations of physicians appear, concerning the supposed influence which lime-water, and other substances have in the generation of stone.

Although urine in general contains most if not all the parts which compose calculus, yet, without the concomitant existence of certain circumstances, it is seldom generated. One of the principal of these conditions, is, what is commonly called a nucleus, or a body upon which, the stone is gradually deposited from the urine. Foreign matters are sometimes known to serve as nuclei for the accretion of stone; and we can readily conceive, and indeed the fact is certainly ascertained, that, when the urine abounds with calculous matter, masses of stone are formed without the presence of nuclei. In these cases, the quantity of calculous matter, being so

* See the works of Fourcroy and Vauquelin.

abundant, of which we have many hiſtories, upon the higheſt authority,* it is probable that the urine is unable to hold it all in ſolution, and, therefore, parts of it are precipitated, which adhere together and in time are conſolidated. But the moſt common kind of nucleus is, we ſuppoſe, the coagulable lymph of the blood, which is ſometimes effuſed by inflamation into the pelvis of the kidnies, or the urinary bladder. Two facts render this ſuppoſition at leaſt plauſible. *First*, from a comparative examination, but few calculi are found containing nuclei. The reaſon of this is, that,

*The following is the hiſtory of a caſe which came under the care of Dr. Wiſtar. The friends of a girl, about nine years of age, requeſted the Doctor's advice concerning a ſtone in the urinary bladder, the exiſtence of which, the Doctor was ſatisfied from examination, and ſoon after extracted it by dividing the urethra towards the vagina. The child in a ſhort time recovered: but ſome months after, new ſymptoms of calculus made their appearance. The child would not ſubmit to any further examination this time; during which, ſmall calculi came away daily. I have at leaſt fifty of theſe calculi, one of which is as large as an hazle nut, of a triangular figure. The patient died laſt April with a number of ſtones in the bladder and ſome, perhaps, in the kidneys. No nuclei were found in any of theſe ſtones A very ſmall quantity of white powder was diſcovered in many of them, when broke. This ſtate of the ſyſtem, may be called, with propriety, a *calculous diathesis*.

the coagulable lymph being eaſily deſtroyed ſoon diſappears in them. And, *secondly*, the formation of ſtone is frequently preceded by inflamation, which moſt commonly attacks the kidneys, in which, calculus, in a majority of caſes, perhaps, originates. Were this laſt fact more generally and more particularly attended to in practice, and the proper remedies for obviating and relieving inflamatory affections of the urinary organs and receptacles adminiſtered it is more than probable that many caſes of ſtone might be thereby effectually prevented. But that wonderful and exceſſive diſpoſition which exiſts in ſome habits to ſecrete the matter of calculus, makes us deſpair of ever being able to prevent in every caſe the formation of ſtone.

The *modus operandi* of medicines, called lithontriptic, has engaged much of the attention and ſtudy of phyſicians for many ages. The afflictive train of ſymptoms which accompany the ſtone, is of too ſerious a kind not to have called forth the tender ſympathy and active exertions of humanity to its relief. No condition of human nature is more painful to the body, or more melancholy to the mind of man, than a paroxyſm of the ſtone.— It excites a diſmal gloom, to which, all are

ſtrangers but the patient. No ſtate can therefore, more powerfully command the compaſſionate feelings of a fellow-creature. But after all the labour and attention of phyſicians, the ſufferer derives but partial aſſiſtance, and that but ſeldom, from the uſe of medicine. He is, for the moſt part, obliged to paſs away a life of miſery, or ſubmit to one of the moſt painful of all ſurgical operations.

From a candid view of our knowledge concerning the action of lithontriptics, it will appear perhaps, that we are in poſſeſſion of but little certainty or truth on the ſubject. It is now even doubtful that medicines are abſorbed into the general circulation. If this be the caſe, to the truth of which, we are not at preſent diſpoſed to object, what an extenſive courſe of ſophiſtry and train of laboured reaſoning is at once deſtroyed. No ſubject exhibits a more ſtriking proof of the error that prevails in medical philoſophy—the *methodus medendi* at leaſt, than the one before us. Although it may be degrading to the dignity of the medical profeſſion, and even diſguſting to the feelings and ſentiments of many phyſicians, it is nevertheleſs true, that few, if any, are qualified to explain the operation of medicines upon rational—much leſs,

upon ſatisfactory principles. If medicines are not abſorbed, it would be in vain to adminiſter them with a view of diſſolving urinary calculi. But the probability of a certain action of the abſorbents, I mean the retrograde motion of their contents, has given a new turn to the inveſtigation. But granting all the force which ingenuity deſerves in ſuggeſting this doctrine—not in erecting it, for the aid of fact and experiment is yet wanting on the ſubject. We preſume that our belief in its being groundleſs is not premature. From a cloſe attention to the natural functions of the abſorbents, their ſtructure, as well as from a pathological point of view, we are conſtrained to declare that no retrograde motion of their contents does take place. The abſorbing veſſels ariſe from all the different ſurfaces and cavities of the body, and terminate in the *thoracic duct*, where their contents are depoſited. It is not to be ſuppoſed that veſſels, ſuch as the lymphatics, which are naturally intended to convey fluids one way, ſhould carry them directly the contrary. Such a tendency as this, would be more effectually prevented in the abſorbents than in the veins; which no perſon ſuppoſes ſuffer their contents to go backwards. The valves of the abſor-

bents, like thoſe of the veins, are calculated to ſuffer the tranſmiſſion of their contents one way, *viz.* towards the *thoracic duct*, but not the other ; and there exiſting ſo great a number of theſe, is ſufficient to ſhew that nature has been provident to fulfil this wiſe intention. But in diſeaſe, we never obſerve this retrograde motion—the only affection obvious to our ſenſes, is a want of tone or action in the abſorbents. But it is ſaid there are a ſet of veſſels which go from the ſtomach directly to the bladder, through which, medicines may be conveyed. We know of no ſuch veſſels—we never have ſeen them—we believe no anatomiſt has, or perhaps ever will be able to demonſtrate them ; and the only fact adduced in ſupport of it, which deſerves any notice, is the ſudden formation of a large quantity of urine in conſequence of having taken certain ſubſtances into the ſtomach. This kind of urine, which is called *urina potus* by ſome gentlemen, poſſeſſes but few of the common properties of urine. It is inſipid, inodorous, without colour, and reſembling water more than any thing elſe. But we can more readily conceive, of the kidneys forming this kind of urine, than that it paſſes through a new ſet of veſſels, from the ſtomach to the

bladder. As it is uncommon, it probably is a diſeaſed ſecretion; of which, we know the kidneys, like other glands, are capable. But even admitting that there is a retrograde, or what is ſometimes called an inverted periſtaltic action of the abſorbents, or a direct communication to the bladder, we know that all foreign matters, medicines, for inſtance, will be changed by the veſſels, in their paſſage through them—conſequently, no application can be made of theſe doctrines to the immediate influence of medicines upon the ſtone: We therefore believe, that no lithontriptic medicine ever arrives at the bladder, in that ſtate in which it was previouſly thrown into the ſtomach.

No. I.

Analysis of a calculus presented to me by Dr. Wistar, who extracted it from the urinary bladder of a child.

This ſtone was large, rough, and white on the external ſurface, being grey and more porous towards the center, in which nothing like a nucleus could be diſcovered. It was irregularly laminated; and the plate which was interpoſed between the external white and

the internal grey portions of the ſtone, was harder than any other part, and preſented from the ſurface of its fracture, a great number of ſmall ſhining points.

Experiment 1.—Forty grains of this ſtone were boiled on Argand's lamp, in the nitric acid, diluted with diſtilled water, and in a ſhort time it was entirely diſſolved, without efferveſcence, (a) the reſidue, after evaporation was of a beautiful roſe colour. (b) This reſidue was freed from the ſuperabundant acid by ſeveral waſhings in diſtilled water, and ſucceſſive evaporations; it was afterwards boiled a conſiderable time in diſtilled water, in which part of it was diſſolved. By adding a few drops of the oxalic acid to ſomeof the clear ſupernatant liquor, the inſoluble part having ſubſided, a white precipitate (c) was immediately formed.

Experiment 2.—A quantity of the ſtone being diſſolved in the nitric acid, diluted with diſtilled water, was added to a pure aqueous ſolution of the acetate of lead, and a copious white precipitate was produced. (d)

Experiment 3.—To a quantity of this ſolution, the nitrate of ſilver was added, a copious white precipitate was obtained, (e) but

on adding the muriated barytes to part of the ſame ſolution, no change was produced. (f)

Experiment 4.—Two drachms of the ſame ſtone powdered were boiled an hour in the cauſtic vegetable alkali and then filtered, when after examination, twenty-four grains appeared to have been taken up by the alkaline ſolvent (g)

Experiment 5.—A fragment of this ſtone was powdered in a mortar, to which I added a piece of the cauſtic vegetable alkali, and rubbed them together, by which a ſtrong ſmell of volatile alkali was diſengaged. (h)

Experiment 6.—A fragment of the ſame ſtone, weighing 24 grains, was expoſed in a crucible to a high degree of heat, 30 minutes after it became cool, it aſſumed a pale blue colour, was unchanged in figure, but had loſt in weight 8 grains. (i)

From the above experiments, it therefore appears, that this ſtone contained no carbonic acid; (a) but the lithic acid (b), as well as lime (c) and the phoſphoric acid (d), and the marine acid (e), but no ſulphuric acid (f); the preſence of one or more acids, is ſuppoſed from (g), and the actual exiſtence of volatile alkali from (h), and the exiſtence of mucilaginous as well as of aqueous parts preſumed from (i).

No. II.

*Analysis of a calculus extracted from the urinary bladder of a girl.—It was white, friable, light, irregularly laminated and destitute of nucleus.**

Experiment 1.—Thirty three grains of this ſtone were diſſolved in the nitric acid diluted with diſtilled water, by the aſſiſtance of heat. The ſolution was attended with effervescence, and a diſcharge of nitrous gas; it was then evaporated and the ſuperabundant acid thrown off by waſhing and evaporating, after which ſome diſtilled water was poured upon the reſidue, and ſuffered to ſtand. After ſome time, it was partially diſſolved, and to a portion of the clear liquor,

Experiment 2.—I added a few drops of the acetate of lead, and a white precipitate was thereby formed.

Experiment 3.—To ſome of the ſame liquor, I added the oxalic acid, which ſtruck a white cloud:

Experiment 4.—To another portion of the ſame liquor, the muriated barytes was added, but no change was obſerved.

Experiment 5.—A white precipitate was produced by mixing nitrated ſilver with ſome of the ſame liquor.

* See note page 4.

Experiment 6.—Thirty grains of the ſame ſtone were boiled in the ſame cauſtic vegetable alkali—a conſiderable quantity remained undiſſolved, having filtered it, the clear liquor was ſaturated with the muriatic acid, and a precipitate of a green colour, was thereby formed. The liquor was of the ſame colour, likewiſe, which colour it poſſeſſed when diſcharged from uſe; this green precipitate was obtained by filtering, and then dryed; after which, a portion of it was triturated with ſome cauſtic vegetable alkali, but no ſmell of ammoniac was perceived.

Experiment 7.—The precipitate was partly ſoluble in alkohol, but more ſo in water, and imparted a green colour to both.

Experiment 8.—On the remainder of the precipitate, I poured ſome nitric acid, and a beautiful red colour was inſtantly produced, and a conſiderable degree of heat generated. In cooling, a yellow powder was gradually depoſited; After this powder had ſubſided, the red liquor was decanted, and to ſome of it I added the acetate of lead, by which, a copious precipitation was produced.

Experiment 9.—A beautiful pale red colour, but no precipitate, was formed by ad-

ding ſome cauſtic vegetable alkali to ſome of the ſame liquor, until it was ſaturated.

Experiment 10.—The oxalic acid was added to a part of the ſaturated liquor of the laſt experiment, but no change was produced.

Experiment 11.—To another portion of the ſame liquor, the ſulphuric acid was added, but no change was obſerved.

Experiment 12.—To that part of the calculus which was not diſſolved in experiment 6, I again added cauſtic vegetable alkali, and boiled them together; but ſome remained inſoluble. It was filtered, and the liquor which paſſed through the ſtrainer, was ſaturated as before with the muriatic acid; the ſame kind of precipitate was thereby obtained, but no green colour was obſerved in the liquor. On adding the nitric acid to this green precipitate, when dry, no red colour was formed, as in the former, but it was diſſolved.

Experiment 13.—That part which remained undiſſolved in the laſt experiment, was treated again in the ſame manner, and attended with the ſame phenomena preciſely.

Experiment 14.—A few grains of the calculus were triturated with the cauſtic vegetable alkali, which produced a ſtrong ſmell of volatile alkali.

We may conclude that the ſtone, upon which, the laſt foregoing experiments were performed, did not contain any carbonic acid, the effervescence which was obſerved in experiment 1. was, probably, only owing to a decompoſition of the nitric acid, and not to a diſengagement of fixed air; we infer that the phoſphoric acid exiſted from experiments 2 and 8, and lime from experiment 3, although rendered doubtful by experiments 10 and 11. Experiment 4 tends to ſhew that there exiſted no ſulphuric acid; the exiſtence of the muriatic acid is ſuppoſed from experiment 5; experiments 6, 7 and 8, prove the exiſtence of acids; experiment 7, detects a gum-reſin; experiments 8 and 9, the lithic and phoſphoric acids; experiment 14, detects poſitively the volatile alkali.

No. III.

Analysis of stones presented to me by Dr. Barton, which were taken from the kidney of a sheep.

Theſe ſtones which were of a green colour, lamellated, light, brittle, and from the ſize of an hazlenut, to that of a pin's head; occupied and diſtened very much, the pelvis

of the kidney. This diſtenſion was ſo great, as to have deſtroyed the parenchymatous ſubſtance of the gland.

Experiment 1.—On forty grains of theſe ſtones, I put ſome nitric acid, and a beautiful deep red colour was inſtantly formed; and a conſiderable degree of heat generated; this colour diminiſhed by the addition of water; in cooling, a yellow powder fell to the bottom of the veſſel: Beſides powder, a brown inſoluble matter floated on the liquor; the yellow powder was obtained by filtration, and dried, and upon examination, was found intenſely bitter and aſtringent, as well as entirely ſoluble in alkohol; it was afterwards precepitated from alkohol, by water; the brown matter which floated on the ſurface of the fluid, was ſoluble in water and not in alkohol; it was alſo ſoluble in cauſtic alkali, with which, it formed a brown mixture, but no ſmell of ammoniac was obſerved; it was likewiſe ſoluble in mild pot-aſh, which did not evolve any volatile alkali, but a very fœtid odour.

Some of the red liquor of this experiment, was kept in a vial about three weeks, at the end of which time, the red colour had entirely diſappeared.

Experiment 2.—To the above nitric ſolution, a few drops of the oxalic acid were added, and no alteration was obſerved.

Experiment 3.—Some of the nitric ſolution, was ſaturated with cauſtic vegetable alkali and acquired a pale red colour, but formed no precipitate. To ſome of this ſolution, I added a few drops of the oxalic acid, and the liquor became cloudy.

Experiment 4.—A quantity of vitriolic acid, was added to the ſaturated ſolution, and no change enſued.

Experiment 5.—No change was produced by adding ſeparately the alkohol of galls and pruſſiate of pot-aſh to the ſaturated nitric ſolution.

Experiment 6.—The acetate of lead, produces a copious white precipitate, in the pure nitric ſolution.

Experiment 7.—In the ſaturated ſolution, no change was produced by the nitrates of ſilver and mercury.

Experiment 8.—Some of the ſame ſtones were boiled in the cauſtic vegetable alkali; which diſſolved them entirely. The colour of the ſolution was almoſt black. To a portion of this ſolution, diluted with rain water,

I added ſome oxalic acid ; no precipitation took place.

A portion of this cauſtic ſolution ſtood about three weeks in a viol and the colour had entirely diſappeared.

Experiment 9.—Some of the alkaline ſolution was ſaturated with ſulphuric acid, which formed a copious white precipitate.

Experiment 10.—On adding ſeparately the pruſſiate of pot-aſh and alkohol of galls, to ſeparate portions of the alkaline ſolution, no blue nor black colour was produced.

Experiment 11.—Some of the alkaline ſolution was ſaturated by the muriatic acid, which produced a white cloud, which did not ſubſide until ſeveral hours had expired.

Experiment 12.—A fragment of the ſame parcel of ſtones was placed in a crucible and expoſed to a great heat. It inſtantly ſwelled up, and a diſagreeable odour was diſſipated from it. A black coaly matter remained in the crucible.

Experiment 13.—The ſulphuric acid, had no action on theſe ſtones, without heat : it however diſſolved them, when heat was applied, and formed a thick black liquor, reſembling common molaſſes : The muriatic acid, had no action on them.

Experiment 14.—A quantity of theſe ſtones were boiled in diſtilled water for an hour. Nothing ſeemed diſſolved; when cool, the liquor did not change the colour of litmus paper and no precipitate was obſerved on cooling.

Conclusions from the foregoing experiments.

Is not the exiſtence of the lithic acid, proved by experiment 1? The moſt ſenſible proof of which, was the formation of the red colour by the nitric acid; it ſtained the ſkin, wood, ivory, and glaſs—red; which is a characteriſtic mark of the lithic acid. The ſame colour was obtained from No. 2, but by a different treatment. *See experiment* 8, *p.* 19. Every author, whoſe works I have examined, declares that the lithic acid exiſts only in the human urinary calculus, except Dr. Pearſon who found it in gouty concretions.* But we have in this experiment, a ſtrong evidence of its exiſtence in the urinary calculus of a ſheep.

It ſeems probable that a gum reſin exiſted in this ſtone. The yellow powder which was inſoluble in the acid, (in experiment 1), was

* Philoſophical Magazine, Vol. II. p. 132.

entirely diſſolved in alkohol, and precipitated from it by water, by which circumſtance, a reſin is diſtinguiſhed; and the brown matter was, on the other hand, ſoluble in water and not in alkohol.

Experiment 2, ſhews that there exiſted no lime; but experiment 3, is a poſitive proof of the contrary, and ſhews that the nitric acid in experiment 2, prevented the combination of the acid of ſugar with the calcarious earth. Experiment 4, does not invalidate the above inference; becauſe the ſulphuric acid will not always, and does very ſeldom, form evident cryſtals of ſelenite when poured into lime-water. Experiment 8, is an exception to the inference from experiment 3.

Experiments 5 and 10, declare the non-exiſtence of iron. Experiment 6, exiſtence of phoſphoric acid.

Experiment 7, non-exiſtence of muriatic acid.

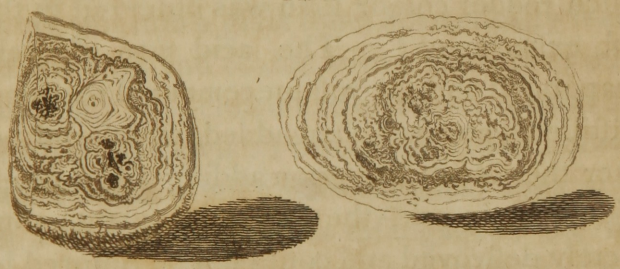
No. IV.

Analysis of an urinary calculus, taken from a woman by Dr. Shippen, the Father of the present Professor.

It was about the ſize of a pullets egg, of the ſhape of a heart, depreſſed on two ſides,

the colour in the inſide was brown, the next layer was white; which was ſeparated from another layer, which was yellow, by a hard and dark layer. The next layer was of a yellow and brown colour intermixed, and the moſt external was of a light brown colour, and very eaſily ſeparated from that with which it was connected. *See Plate I.*

Plate I.



J. Akin Fecit

Experiment 1.—A part of the external layer was diſſolved in the nitric acid, as well without, as with the aſſiſtance of heat, with efferveſcence. It was all diſſolved and the liquor appeared clear; but after ſome evaporation it aſſumed a red colour. This was a proof of the lithic acid.

Experiment 2.—I added to ſome of this ſolution ſome ſugar of lead, diſſolved in rain water, which produced a white precipitate—a proof of the exiſtence of phoſphoric acid.

Experiment 3.—The nitric ſolution after ſtanding ſome time depoſited large cryſtals which I could not examine as they were loſt by an accident.

Experiment 4.—To another part of this ſtone, moſtly from the inſide, I added ſome nitric acid. By evaporation, this aſſumed a much redder colour than was obſerved in the laſt experiment.* The acid was entirely evaporated and the reſidue remained very red. Diſtilled water was then added, which did not alter the colour, but upon adding a few drops of the nitric acid the red colour was completely deſtroyed and could not be reſtored by evaporation even to perfect dryneſs.

Experiment 5.—To ſome of the clear liquor I added ſome oxalic acid—it remained unchanged; conſequently, there exiſted no lime.

Experiment 6.—To another portion was added the acetate of lead and a white precipi-

* This ſhews that the lithic acid, may not only be more abundantly, in one ſtone than another; but alſo in different parts of the ſame ſtone.

tate was formed. This experiment coincides with the 2nd.

Experiment 7.—16 grains of this ſtone were expoſed to a violent heat in a crucible ; after ſome time it became black, and took fire ; preſenting the appearance of the glow worm. The remainder was nothing but white aſhes, weighing only three grains. The loſs of weight was owing to the diſſipation of aqueous and perhaps of animal or mucilagenous matter.

Experiment 8—200 grains of this ſtone were put into a glaſs tube, hermetically ſealed at one end, and coated with a mixture of dung and clay ; the cloſed extremity was expoſed to the heat of Lewis's Furnace, and the other connected with a pneumato-chemical apparatus ; in a ſhort time air was diſengaged ; the firſt two ounce meaſures I did not examine, as I ſuppoſed it was the air of the tube ; the ſecond two ounce meaſures, being examined by the eudiometer conſiſted of 60 parts of carbonic acid, and the remaining 40 were nitrogene ; two ounces more came over—this conſiſted of carbonic acid 10, and of azote 90 ; no inflamable air, or oxigene could be diſcovered ; the tube was then broken, and the matter examined, which emitted a ſtrong ſmell

of ammoniac, and a browniſh ſublimate of an empyreumatic ſmell, adhered to the ſides of the tube.*

Some of the ſame ſtone, finely powdered, was put into a very ſmall quantity of nitric acid, and placed upon Argand's lamp, by means of which the acid was ſoon evaporated. I now added by drops, the ſame nitric acid, which produced true inflamation, like that of phoſphorus; but it was not attended with the crackling noiſe—white aſhes were left behind. This inflamation could be produced at pleaſure, by adding the acid.

No. V.

Analysis of a stone taken from the intestines of a horse.

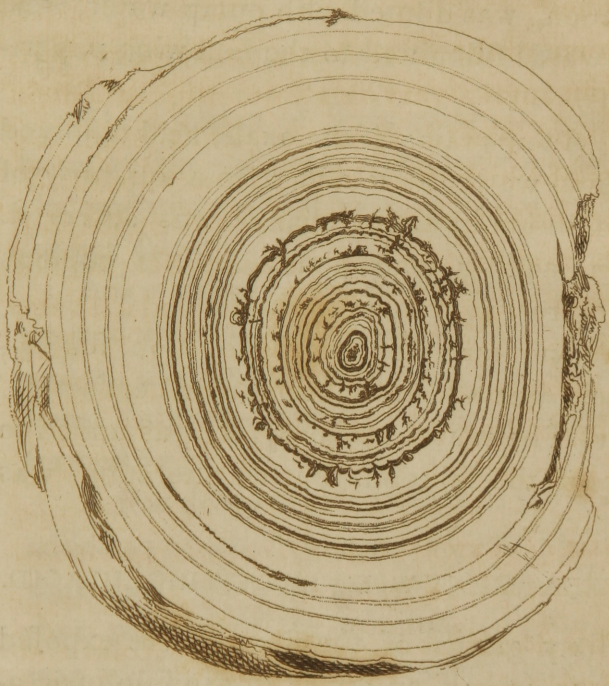
This ſtone was large, laminated, ſolid and of a dark colour. *See plate* II.†

* Mr. Fourcroy, has made an experiment ſomewhat ſimilar, but obtained no gas. Annal. de Chemie. Tome. xvi. p. 141. Mr. Hales obtained large quantities of elaſtic fluid, Veget. Statics.

† The horſe in whoſe inteſtines this ſtone was found, uſed to work in a mill, where gypſum was occaſionally ground; and the owners were accuſtomed to feed him on corn, which had been paſſed through the mill ſtones, for the purpoſe of cleaning them; there conſequently muſt have been a large quantity of gypſum mixed with it.

The current opinion was, that the preſence of calculi, and the conſequent death of the horſe, was occaſioned by

Plate II.



I. TREATMENT WITH THE MURIATIC ACID.

A quantity of this acid was poured upon one drachm of the ſtone, pulverized and expoſed to the heat of an Argand lamp; in 30 minutes it was all diſſolved, without effervescence (a) except three grains which remained at the bottom of the veſſel, preſenting the

the gypſum. But the following experiments clearly demonſtrate, that the formation of the calculus on which I experimented (for ſeven others, were taken from the ſame horſe) did not depend on the preſence of lime.

appearance of mucilage; this ſolution, after filtration, was diluted with pump water, and afterwards ſubmitted to the following experiments.

(b) A few grains of the oxalic acid diſſolved in pump water, were added to a quantity of the ſolution, but no change was obſerved. Upon adding ſome lime-water, a copious white precipitate was produced.

To another portion of the ſolution, ſulphuric acid was added, but no change enſued.

(c) The muriate of barytes, was added to ſome of the ſolution, but no alteration was perceived.

II. TREATMENT WITH THE VITRIOLIC ACID.

Sixty grains of the ſtone, were expoſed an hour, in half an ounce of the ſulphuric acid, diluted with two ounces of pump-water, to the heat of Argand's lamp. It was all diſſolved, except ſix grains of black mucilagenous matter, which ſwam on the ſurface of the fluid. During the ſolution, no effervеſcence (d) was obſerved. A quantity of this ſolution was ſaturated with cauſtic pot-aſh, which formed a white brown precipitate. In this ſituation it was ſuffered to remain twelve hours, at the end of which time, a number of cryſtals (e)

in fine needles were formed, ſuſpended in the mixture.

III. TREATMENT WITH THE NITRIC ACID.

The ſolution of ſixty grains of the ſame ſtone in this acid, was attended with the ſame circumſtances which were obſerved in the two former ſolutions (f)

A few drops of the muriated barytes were poured upon a quantity of the nitric ſolution, and no change was obſerved; but by adding ſome ſulphuric acid, a white cloud was formed (g)

A few drops of the oxalate of pot-aſh were added to another portion of the nitric ſolution, and no change was perceived. To another portion of the ſolution, ſulphuric acid was added, and in like manner no alteration produced (h)

By adding ſome of the nitrate of ſilver to ſome of the ſolution, a ſmall white precipitate was formed, which reſembled exactly that produced by adding ſome of the nitrate of ſilver to the nitric acid, part of which, had been uſed in the ſolution of the ſtone, diluted with water (i)

The acetate of lead, diſſolved in diſtilled water, was added to a quantity of the ſolution;

and a precipitate, as white and as thick as cream, was formed (j)

To a quantity of nitric acid, (part of which had been uſed in the ſolution of the ſtone,) diluted with rain water, I afterwards added ſome of the acetate of lead, of the ſame vial as before, but no change reſulted from the experiment.

A quantity of the nitric ſolution was ſaturated with cauſtic pot-aſh, and a copious brown precipitate was thereby formed. After filtration, the precipitate was dried, and then aſſumed a yellow colour. This precipitate deliqueſced (k) ſlightly and diſſolved with difficulty, and only partially, in cold and boiling water; a quantity of this precipitate was entirely diſſolved in the ſulphuric acid.

A piece of the inteſtinal calculus was triturated in a mortar with cauſtic pot-aſh, and a diſengagement of ammoniac was ſmelled (l). The ſame thing was perceived by triturating the pot-aſh with the reſidue from the evaporation of the nitrous ſolution of this ſtone.

A fragment of the ſame ſtone, weighing 44 grains, was expoſed in a crucible to a high degree of heat. At firſt it became white; then black; and after ſome time inflamed, like charcoal: when cool it reſumed

the white colour, weighing only 20 grains—was very porous and retained its former figure. It was then boiled a conſiderable time in water, but was inſoluble.

By treating this ſtone with the nitric acid to detect the lithic acid, no red colour could be obtained. After making a ſolution of the ſtone with nitric acid, and ſaturating it with cauſtic vegetable alkali, which produced a yellow precipitate, and ſuffering it to ſtand ſeveral days, I could perceive no cryſtals except thoſe of nitre, adhering to the ſide of the veſſel.

The ſame experiment was made on the ſtone in the muriatic acid, but with a different reſult. Cryſtals reſembling muriate of ſoda were obtained.

A part of the ſtone was partially diſſolved in cauſtic vegetable alkali, filtered and ſuffered to ſtand ſeveral days, at the end of which time, a number of ſmall cryſtals were depoſited at the bottom of the veſſel.

Having pulverized ſome of the ſtone, I added to it ſome mild vegetable alkali, and expoſed it to heat in a crucible ; when taken from the fire nitric acid was added to it. A number of red ſpots were obſerved at the bottom of the veſſel, while the powder was

diſſolving. I made the ſame experiment with this ſtone without the pot-aſh, but could not produce the red ſpots.

Inferences from the foregoing experiments.

The non-exiſtence of the carbonic acid is clearly aſcertained by experiments a. d. & f.

From b & h it appears that there does not exiſt any lime.

The non-exiſtence of ſulphuric acid, as well as the muriatic, is likewiſe proved by c g and i.

We preſume that the exiſtence of animal mucilage is aſcertained by the three acid ſolutions 1, 2, 3.

The exiſtence of the phoſphoric acid by j, and of its combination with clay and ammoniac, we have preſumptive evidence in e.

The actual exiſtence of ammoniac is poſitively determined by l.

The cryſtals in e. were the regenerated calculus; and the precipitate k was the the ſame. Some inteſtinal calculi are cryſtalized in needles ſomewhat reſembling the cryſtals I obtained.

I made the following experiment upon ſix diſtinct urinary calculi, taken from different patients, with a view of detecting the lithic

acid. The experiment was performed upon each ſeparately.

The ſtone being diſſolved in the cauſtic vegetable alkali, and ſaturated with the muriatic acid, a precipitate was obtained, which was dried; when nitric acid was poured on it, a red colour was formed (the evidence of the lithic acid) in one only of the ſix: An urinary calculus of a ſheep, an urinary calculus of a cow, and the inteſtinal calculus of a horſe were treated in the ſame way, but no red colour was produced.

To ſeparate portions of diſtinct human urinary calculi, I added nitric acid, and afterwards evaporated them to dryneſs; by which, a roſe or deep red, colour, was produced in all. An inteſtinal ſtone of a horſe, and an urinary calculus of a cow were treated in the ſame manner, but no red colour was produced.

It has been obſerved above, that this red colour was formed in the ſheep's ſtone by pouring the nitric acid on it immediately; this was the only inſtance, among all the calculi, in which the red colour could be formed in that manner.

By adding the muriatic and nitric acids to freſh urine, the lithic acid was precipitated after ſtanding ſome hours in the form of dark

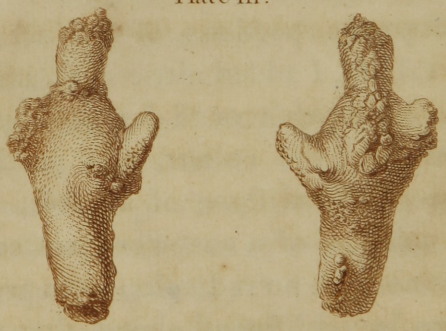
red chryſtals. On theſe cryſtals, I poured ſome nitric acid. They were diſſolved with efferveſcence, and the liquor poſſeſſed the colour of the acid uſed.

On the ſediment of urine dried, I poured ſome of the ſame nitric acid—it likewiſe efferveſced, but did not form a red colour.

No. VI.

Analysis of a calculus, taken out of the kidney of a cow.

Plate III.



J. J. Barralet del.

James Akin sculp.

This ſtone was preſented to me, by Dr. Meaſe ; it had the figure of a branch of the pelvis, having a protuberance on each ſide of it ; the greater part of the ſurface, was tuberculated, more particularly, at the extremities;

the external ſurface of the ſtone, had, in ſome places, a metallic appearance, reſembling poliſhed gold. On removing the external coat, which was formed of very fine laminæ, the next appeared ſtill more brilliant, and was diffuſed over the entire ſurface; on breaking the ſtone, the laminæ were thin and brittle, reſembling mica, and the ſaw penetrated with greater difficulty than in any other ſtone I examined: The metallic appearance, was not deſtroyed by rubbing nitric acid over it, although it effervesced violently. On rubbing ſome mercurial ointment on it; it became much darker.

Experiment 1.—A part of this ſtone, was boiled in cauſtic alkali, by which a large proportion was diſſolved; it was ſuffered to cool and then filtered.

Experiment 2.—To ſome of this liquor I added, a few drops of the oxalic acid; no change was obſerved; but on adding ſome lime water to it, a cloud was produced, which immediately diſappeared; this ſeems to prove that the lime was not taken up by the alkali, as lime was evidently detected by another experiment.

Experiment 3.—Some of this ſtone, moſtly of the internal part, was boiled in nitric

acid ; a violent effervescence ensued ; it was evaporated but no red colour was produced. When it was dry, distilled water was added, till all the acid was thrown off. A large quantity of the stone remained dissolved in the liquor.

Experiment 4.—To a portion of this liquor I added a portion of the oxalic acid ; a white precipitate immediately ensued.

Experiment 5.—To another portion I added some acetate of lead ; no precipitate was observed: but upon adding a drop of the phosphoric acid, a white precipitate was thrown down.

Experiment 6.—To another part, was added the alkohol of galls—no black colour was produced: The same thing was tried with the prussiate of pot-ash, separately, with the same result.

Experiment 7.—With muriated barytes, it formed no precipitate.

Experiment 8.—With the nitrate of mercury, no precipitate was formed ; but on adding one drop of muriatic acid, a copious white precipitate, was obtained.

Experiment 9.—A piece of this stone, was rubbed in a mortar, with caustic vegetable

alkali, by which a ſtrong ſmell of ammoniac, was produced.

Conclusions from the above experiments.

Experiment 3 evinces the preſence of the carbonic, but not the lithic acid.

Experiment 4 proves the exiſtence of lime.

Experiment 5 ſhews the non-exiſtence of phoſphoric acid.

Experiment 6 the non-exiſtence of iron.

Experiment 7 the non-exiſtence of ſulphuric acid.

Experiment 8 ſhews that the muriatic acid, was not preſent.

Experiment 9 poſitively proves the exiſtence of ammoniac.

FINIS.